INDOOR AIR QUALITY ASSESSMENT

Mass Commission for the Blind and
Mass Commission for the Deaf and Hard of Hearing
600 Washington Street, 3rd Floor, Boston, MA

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
November 2017

Background

Building:	MA Commission for the Blind/MA Commission for the Deaf and Hard of Hearing
Address:	600 Washington Street, 3rd Floor, Boston
Assessment Requested by:	Sharlene Sharif, Executive Office of Health and Human Services (EOHHS) Field Operations
Reason for Request:	General Indoor Air Quality (IAQ) and health concerns
Date of Assessment:	October 30, 2017
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Ruth Alfasso, Environmental Engineer, indoor air quality (IAQ) Program
Building Description:	The offices examined are on the 3rd floor of a seven-story, brick-faced building. The building underwent interior renovations in 2011. It has a flat roof with a black rubber membrane.
Windows:	Not openable

Methods

Please refer to the IAQ Manual for methods, sampling procedures, and interpretation of results (MDPH, 2015).

IAQ Testing Results

The following is a summary of indoor air testing results (Table 1).

- ***Carbon dioxide*** levels were below 800 parts per million (ppm) in all but one area surveyed, indicating adequate air exchange.
- ***Temperature*** was within the recommended range of 70°F to 78°F in all areas tested.
- ***Relative humidity*** was within or slightly above the recommended range of 40 to 60% in the areas tested.

- ***Carbon monoxide*** levels were non-detectable (ND) in all areas tested.
- ***Fine particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality (NAAQS) limit of 35 $\mu g/m^3$ in all areas tested.

Ventilation

A heating, ventilating and air conditioning (HVAC) system has several functions. First it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally-occurring indoor environmental pollutants by not only introducing fresh air, but by filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals.

Fresh air is supplied by air handling units and delivered to supply vents located in the ceilings of rooms (Pictures 1 and 2). Return air is drawn through grates using a plenum return (Picture 3). In some areas, such as bathrooms, directly-vented exhausts are present (Picture 4). Note that although supply and return vents are present in open areas, some offices consist of tall partitions that almost reach the ceiling (Picture 5) and not all of these areas have both a supply and return vent near the top. This configuration may make distribution of fresh air, removal of stale air, and temperature control more difficult especially when doors are closed.

It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). It is not known when the last time these systems were balanced. Balancing should also occur when the space is significantly rearranged.

In a few rooms, strong sunlight was streaming in windows (Table 1) which may contribute to temperature control issues in the office. The use of adjustable blinds to block sunlight and help control temperature in offices with windows is recommended.

Microbial/Moisture Concerns

A few water-damaged ceiling tiles were observed (Pictures 5 and 6). These likely originate with plumbing or HVAC system leaks. Stained tiles should be replaced after a leak is repaired.

Note that some window frames had peeling paint and were otherwise in poor condition, mostly on the outside of the building (Picture 7). No water infiltration was noted or reported, however continued deterioration of window frames can lead to leaks inside.

Plants were observed in some offices and cubicles (Pictures 8 and 9). Some of these plants were in poor condition or located on porous surfaces such as carpet. Plants should be well maintained and not overwatered to prevent odors, water damage, and pests.

Small refrigerators and water dispensers were observed in carpeted areas (Picture 10; Table 1). These appliances may spill or leak and lead to carpet damage and microbial growth. Many of them were placed on waterproof mats already, and it is recommended others be located in areas without carpeting or on waterproof mats. Refrigerators should be kept clean to prevent odors and microbial growth.

Other IAQ Evaluations

Exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. To determine if VOCs were present, BEH/IAQ staff examined rooms for products containing VOCs. BEH/IAQ staff noted cleaners, hand sanitizers, air fresheners and other products in use within the building (Picture 9, Table 1). All of these products have the potential to be irritants to the eyes, nose, throat, and respiratory system of sensitive individuals.

Rodent traps were observed in several areas (Picture 10; Table 1). Rodent infestation can result in IAQ-related symptoms due to materials in their wastes. Mouse urine contains a protein that is a known sensitizer (US EPA, 1992). A sensitizer is a material that can produce symptoms (e.g., running nose or skin rashes) in sensitive individuals after repeated exposure. To eliminate exposure to allergens, rodents must be removed from the building. Please note that removal, even after cleaning, may not provide immediate relief since allergens can exist in the interior for several months after rodents are eliminated (Burge, 1995). Once the infestation is eliminated, a combination of cleaning and increased ventilation and filtration should serve to reduce allergens associated with rodents.

Cooking equipment, including toasters (Picture 11), microwave ovens, and coffee machines, were located in various parts of the office space. Food areas and cooking equipment need to be kept clean to prevent odors and pests.

In some areas, stored materials and accumulated items make it more difficult for custodial staff to clean (Picture 12; Table 1). Items should be stored neatly and moved periodically to allow for wet-wiping and vacuuming of surfaces. The configuration of cubicle walls and dividers create some areas that are difficult to access for cleaning, including some that are used for storage of items (Picture 13). Regular examination and cleaning of these areas, including removal of lost items and debris, should be conducted to prevent the areas becoming harborage for pests or a source of odors. Items should also not be stored on top of radiators (e.g., Picture 14) or in the airstream of ventilation equipment as heating and moving air can cause items to release dusts and odors.

Personal fans were observed in a number of areas. Fan blades to some of these units had settled dust, which can be reaerosolized when the fan is activated.

The offices were mostly carpeted. Carpets should be vacuumed regularly with a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner and cleaned annually (or semi-annually in soiled/high traffic areas) in accordance with Institute of Inspection, Cleaning and Restoration Certification (IICRC) recommendations, (IICRC, 2012). Note that service animals are regularly present in this office and dog hair and dander are common allergens. Because of this factor and any issues with rodents, frequent and thorough cleaning of carpets is needed to remove hair, dander, debris and associated odors. It was reported that carpets had been deep cleaned a few days before this visit. Wet wiping of surfaces to remove dust and potentially allergenic debris is also recommended.

Conclusions/Recommendations

Based on observations at the time of assessment, the following is recommended:

1. Operate supply and exhaust ventilation continuously in all areas during occupied periods. Ensure all HVAC equipment is cleaned/maintained in accordance with manufacturer's instructions. Avoid piling items on top of radiators
2. Have the HVAC system balanced every 5 years in accordance with SMACNA recommendations (SMACNA, 1994). Consider a rebalancing when the building layout is changed.
3. Use adjustable blinds to control solar heating and glare.

4. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
5. Repair plumbing/HVAC leaks and replace water-damaged ceiling tiles.
6. Monitor windows for leakage in areas which appear damaged. Report damaged windows to maintenance.
7. Keep plants in good condition, avoid overwatering, and remove from the airstream of heating and ventilation equipment.
8. Consider the use of waterproof mats underneath all water dispensers and refrigerators to protect carpet. Keep refrigerators clean.
9. Reduce the use of cleaning products, sanitizers, and other items that contain VOCs. Minimize the use of scented products.
10. Ensure that all cooking equipment is kept clean.
11. Use the principles of Integrated Pest Management (IPM) and the services of a licensed pest control operator to remove rodents and reduce the potential for pest infestation. Ensure that any area where rodents may have been is thoroughly cleaned to remove allergens.
12. Reduce the amount of items stored on flat surfaces to allow regular cleaning.
13. Ensure that areas between cubicle walls and the exterior wall of the building are monitored for debris and cleaned regularly.
14. Clean blades of personal fans to prevent aerosolization of dust.
15. Deep clean carpeting semi-annually or more frequently due to the presence of dogs and potential rodent issues per the recommendations of the Institute of Inspection, Cleaning and Restoration Certification (IICRC).

16. Refer to resource manual and other related IAQ documents located on the MDPH's website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at: http://mass.gov/dph/iaq.

References

Burge, H.A. 1995. *Bioaerosols*. Lewis Publishing Company, Boca Raton, FL.

IICRC. 2012. Institute of Inspection, Cleaning and Restoration Certification. Carpet Cleaning: FAQ. Retrieved from http://www.iicrc.org/consumers/care/carpet-cleaning.

MDPH. 2015. Massachusetts Department of Public Health. Indoor Air Quality Manual: Chapters I-III. Available at: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-manual/.

SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

US EPA. 1992. Indoor Biological Pollutants. US Environmental Protection Agency, Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, research Triangle Park, NC. EPA 600/8-91/202. January 1992.

Picture 1

Supply vent along windows

Picture 2

Supply vent

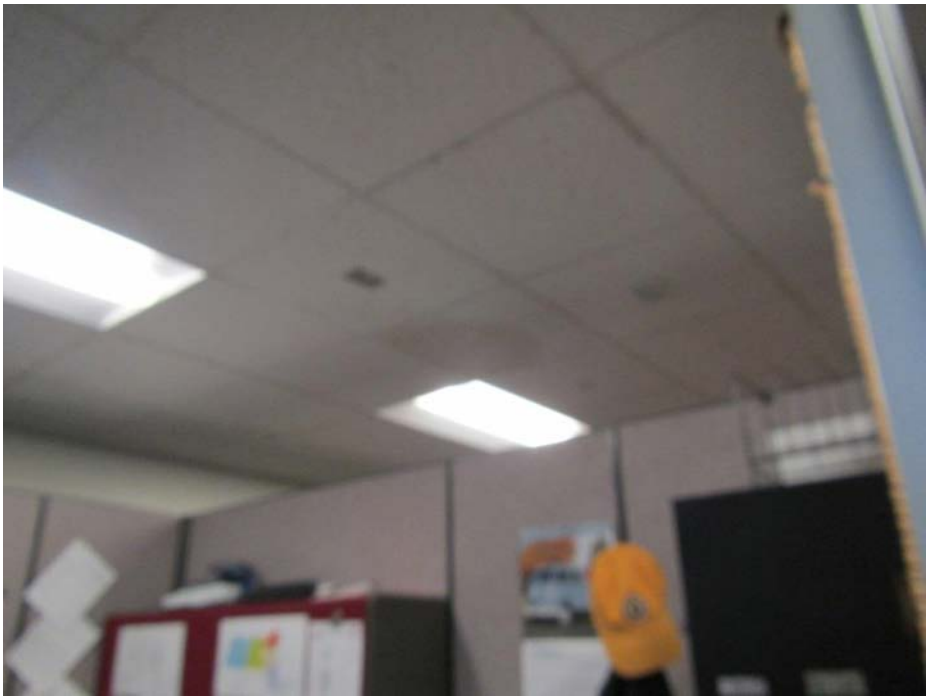
Picture 3

Typical plenum return grill

Picture 4

Direct vented exhaust vent

Picture 5



Almost full-height partition walls, also note water-damaged ceiling tile

Picture 6

Water-damaged ceiling tile

Picture 7

Peeling paint on exterior of window frame

Picture 8

Plant in poor condition with porous materials

Picture 9

Plant and cleaning materials

Picture 10

Refrigerator on carpet, also note mousetrap

Picture 11

Toaster with crumbs

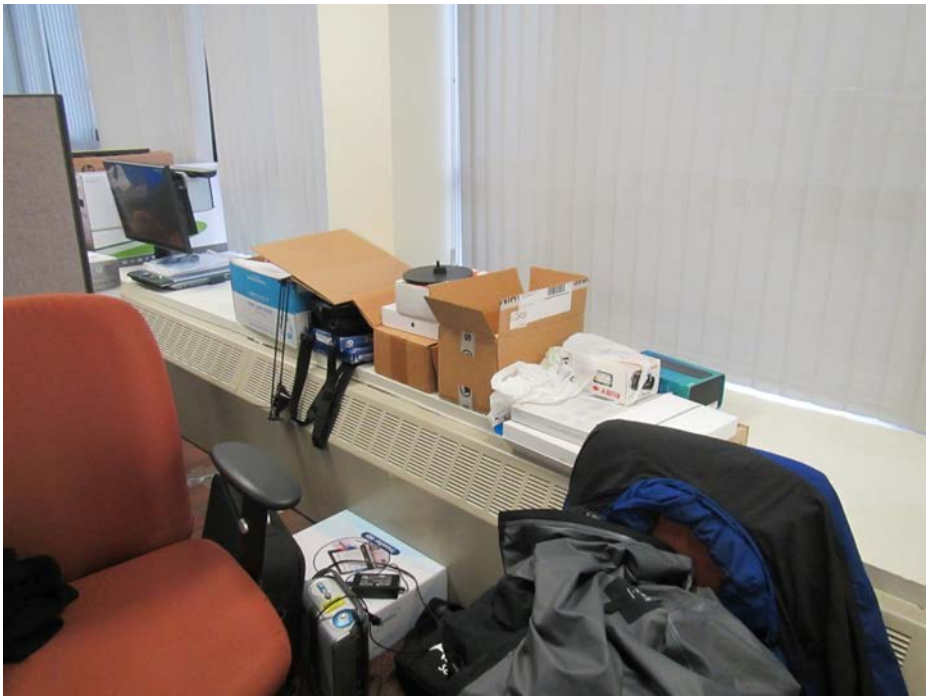
Picture 12

Papers on a desk

Picture 13

Difficult to access storage area between cubicle dividers and exterior wall

Picture 14



Items on radiator

Location: MA Commission for the Blind/MA Commission for the Deaf and Hard of Hearing **Indoor Air Results**

Address: 600 Washington Street, 3rd Floor, Boston **Date: 10/30/17**

Table 1

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m^3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Background	397	0.8	69	49						Very windy, light drizzle
MCB										
Restroom						0	N	Y	Y	
3079-80 cubes	533	ND	70	63	ND	2	N	Y	Y	Items on radiator
3012 cubes	625	ND	73	61	ND	1	N	Y	Y	
3067 cubes	515	ND	71	59	ND	0	N	Y	Y	
3069 recording	514	ND	71	58	ND	0	N	Y	Y	Microphones, shredder
3070 storage	510	ND	71	57	ND	0	N	Y	Y	
3071	879	ND	72	65	1	1	N	Y	Y	
3072	583	ND	71	62	1	1	N	Y	Y	

ppm = parts per million
µg/m^3 = micrograms per cubic meter
ND = non detect
AF = air freshener
AI = accumulated items
CP = cleaning product
CT = ceiling tile
DEM = dry erase materials
DO = door open
HS = hand sanitizer
NC = not carpeted
PC = photocopier
PF = personal fan
WD = water-damaged

Comfort Guidelines

Carbon Dioxide: < 800 ppm = preferable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

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Table 1 (continued)

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m^3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
3073	534	ND	71	62	1	0	N	Y	Y	AI
3075 cubes	534	ND	71	62	7	0	N	Y	Y	HS, items on radiator
3082 cubes	615	ND	70	64	ND	0	N	Y	Y	
3084 records	567	ND	71	59	ND	0	N	Y	Y	NC
3085 Kitchen	501	ND	73	57	ND	0	N	Y	Y	NC, toaster with crumbs, fridge, microwaves
3086	506	ND	73	60	ND	0	N	Y	Y	
3087	542	ND	73	60	ND	1	N	Y	Y	Boxes on floor
3088	516	ND	72	61	ND	0	N	Y	Y	DO, return near door
3089	520	ND	72	62	ND	1	N	Y	Y	Boxes on floor
3090	507	ND	72	62	ND	0	N	Y	Y	Scented spray, plant, food, CP, PF, boxes on floor

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								Supply	Exhaust	
3092	513	ND	71	64	1	0	N	Y	Y	Food
3093	519	ND	71	64	ND	0	N	Y	Y	
3094	546	ND	71	64	ND	2	N	Y	Y	WD CT (2)
3095 cubes	651	ND	72	62	ND	0	N	Y	Y	
3097 cubes	562	ND	72	62	ND	0	N	Y	Y	
3171-74 cubes	434	ND	74	57	ND	0	N	Y	Y	Fake plant in airstream, HS/wipes
3175-78 cubes	457	ND	74	57	ND	0	N	Y	Y	HS/wipes
3099 cubes	541	ND	71	61	ND	0	N	Y	Y	Boxes on floor
3169-70 cubes	454	ND	74	56	ND	1	N	Y	Y	Sunlight, wipes/HS, PF
3100 cubes	583	ND	72	62	ND	1	N	Y	Y	HS/wipes, plush item

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								Supply	Exhaust	
3105	590	ND	73	59	ND	0	N	Y	Y	
3106	501	ND	74	59	ND	1	N	Y	Y	PF, fridge on carpet
3107	578	ND	74	58	ND	1	N	Y	Y	Fridge on carpet in hallway, mousetrap in hallway
3108	633	ND	75	59	ND	1	N	Y	Y	
3109	592	ND	74	59	ND	0	N	Y	Y	Boxes on floor, HS
3110	518	ND	74	57	ND	0	N	Y	Y	PF, food
3121 cubes	508	ND	74	57	ND	0	N	Y	Y	HS, water cooler on mat
3126 cubes	503	ND	74	57	ND	0	N	Y	Y	Items on floor, PF
3129 cubes	523	ND	74	57	ND	1	N	Y	Y	PF, HS

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								Supply	Exhaust	
3131 cubes	520	ND	74	57	ND	1	N	Y	Y	PF
3134	483	ND	73	59	ND	0	N	Y	Y	
3135	588	ND	73	58	ND	0	N	Y	Y	AI, papers
3136	543	ND	73	59	ND	0	N	N	Y	AI, HS, AF
3137 cubes	553	ND	73	59	ND	1	N	Y	Y	
3141 cubes	512	ND	72	58	ND	0	N	Y	Y	Plant, PC, AI
3143 cubes	506	ND	76	58	ND	0	N	Y	Y	Boxes, CP
3146 cubes	503	ND	73	58	ND	3	N	Y	Y	
3148 cubes	514	ND	73	58	ND	0	N	Y	Y	
3151 cubes	504	ND	73	57	ND	0	N	Y	Y	

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								Supply	Exhaust	
3158	480	ND	73	59	ND	0	N	Y	Y	PF, old windows, mouse trap
3159	556	ND	71	59	ND	1	N	Y	Y	
3160	584	ND	73	58	ND	1	N	Y	Y	Fridge on carpet, dog, water bowl
3161 conference	506	ND	73	58	ND	0	N	Y	Y	Fridge on carpet, microwave
3162	514	ND	72	59	ND	1	N	Y	Y	Shredder
3163	522	ND	71	59	ND	0	N	Y	Y	
3164	523	ND	72	59	ND	1	N	Y	Y	
3165	573	ND	72	59	ND	1	N	Y	Y	Boxes on floor
3166	525	ND	72	60	ND	1	N	Y	Y	Shredder
3168	446	ND	74	56	ND	1	N	Y	Y	Sunlight, microwave, papers on walls

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								Supply	Exhaust	
3180	431	ND	71	57	ND	0	N	Y	Y	Dried/fake plant
3181	561	ND	71	56	ND	1	N	Y	Y	Storage and open space behind cube walls, mousetrap
MCDHH										
3007-10 cubes	409	ND	71	54	ND	2	N	Y	Y	HS
3058-60 cubes	523	ND	72	54	ND	2	N	Y	Y	WD CT (2), fridge on carpet, HS
3030-31 cubes	464	ND	72	53	ND	0	N	Y	Y	
3005-06 cubes	408	ND	71	54	ND	0	N	Y	Y	
3011-12 cubes	447	ND	71	55	ND	0	N	Y	Y	Items hanging from ceiling
3038-39	418	ND	70	55	ND	1	N	Y	Y	

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								Supply	Exhaust	
3001	459	ND				1	N	Y	Y	
3002	437	ND	72	54	ND	0	N	Y	Y	Small conference room, DEM
3003	439	ND	72	55	ND	2	N	Y	Y	AI, concerns about IAQ
3004	427	ND	71	54	ND	0	N	Y	Y	
3013 conference	399	ND	71	53	ND	0	N	Y	Y	
3014 storage/resource room	425	ND	70	54	ND	0	N	Y	Y	CP
3016	482	ND	71	54	ND	0	N	Y	Y	
3017	452	ND	71	55	ND	1	N	Y	Y	PF, HS
3018	462	ND	71	55	ND	1	N	Y	Y	

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								Supply	Exhaust	
3019	418	ND	71	54	ND	0	N	Y	Y	PF
3021	406	ND	71	54	ND	0	N	Y	Y	
3022	407	ND	71	53	ND	0	N	Y	Y	
3023	425	ND	72	54	ND	0	N	Y	Y	
3024	432	ND	71	54	ND	0	N	Y	Y	AI
3025	416	ND	71	54	ND	0	N	Y	Y	
3027	459	ND	72	55	ND	1	N	Y	Y	HS and wipes
3028 cubes	396	ND	71	53	ND	0	N	Y	Y	Damaged plant on windowsill, PF
3029	404	ND	71	53	ND	0	N	Y	Y	HS
3034 cubes	409	ND	71	54	1	0	N	Y	Y	

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								Supply	Exhaust	
3037 cubes	432	ND	71	56	ND	1	N	Y	Y	AI
3041	468	ND	70	55	ND	0	N	Y	Y	CP, plants, AI
3042	534	ND	71	56	ND	1	N	Y	Y	
3043	405	ND	71	54	ND	0	N	Y	Y	DEM, AI
3044	393	ND	71	54	ND	1	N	Y	Y	
3045	407	ND	71	54	1	0	N	Y	Y	Very cluttered
3046	414	ND	71	54	1	0	N	Y	Y	PF
3049	444	ND	72	52	ND	0	N	Y	Y	Fabric items and printer
3050	401	ND	72	53	ND	0	N	Y	Y	Wipes
3051	499	ND	72	52	ND	0	N	Y	Y	

ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter
ND = non detect
AF = air freshener
AI = accumulated items
CP = cleaning product
CT = ceiling tile
DEM = dry erase materials
DO = door open
HS = hand sanitizer
NC = not carpeted
PC = photocopier
PF = personal fan
WD = water-damaged

Comfort Guidelines

Carbon Dioxide:	< 800 ppm = preferable	Temperature:	70 - 78 °F
	> 800 ppm = indicative of ventilation problems	Relative Humidity:	40 - 60%

Location: MA Commission for the Blind/MA Commission for the Deaf and Hard of Hearing **Indoor Air Results**

Address: 600 Washington Street, 3rd Floor, Boston **Date: 10/30/17**

Table 1 (continued)

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m^3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
3052	514	ND	72	53	ND	0	N	Y	Y	
3053	502	ND	72	54	ND	1	N	Y	Y	
3056	559	ND	72	54	ND	2	N	Y	Y	Boxes on floor
3061	461	ND	72	53	ND	0	N	Y	Y	
3063	533	ND	72	53	ND	2	N	Y	Y	Boxes on floor
3064 cubes	463	ND	73	53	ND	0	N	Y	Y	
3065	470	ND	73	53	ND	0	N	Y	Y	HS/wipes
3066	493	ND	73	54	ND	0	N	Y	Y	

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